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Annual Fish Passage Report - Rock Island Dam Columbia River, Washington, 1964

By Paul D. Zimmer and John H. Broughton

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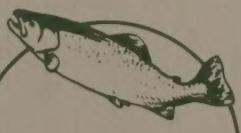

SPECIAL SCIENTIFIC REPORT–FISHERIES No. 515

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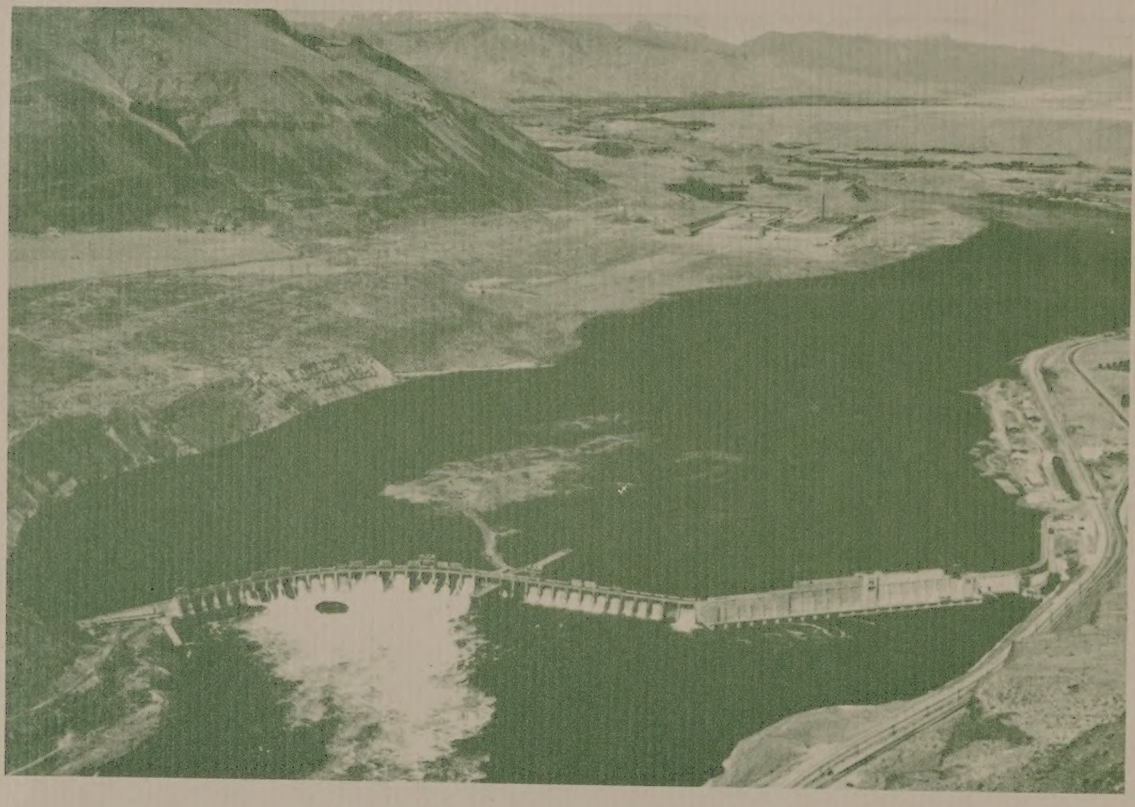

Rock Island Dam, Columbia River, Wash.

UNITED STATES DEPARTMENT OF THE INTERIOR
Stewart L. Udall, *Secretary*
FISH AND WILDLIFE SERVICE, Clarence F. Pautzke, *Commissioner*
BUREAU OF COMMERCIAL FISHERIES, Donald L. McKernan, *Director*

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PAUL D. ZIMMER and JOHN H. BROUGHTON

United States Fish and Wildlife Service

Special Scientific Report--Fisheries No. 515

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ABSTRACT

Fish using the three fishways at Rock Island Dam in 1964 were counted from May 1 to October 24. The total number of salmon and steelhead trout exceeded the 1963 count by 7,885 fish.

The 1964 count of 39,951 chinook salmon was more than twice the mean of 17,355 for the 31-year period 1933-63 and exceeded the 1963 count by 5,263 fish. The 69,411 sockeye salmon counted was 4,643 more than recorded in 1963 and exceeded the 31-year mean of 51,603. The 61 coho salmon counted was about 75 percent of the 31-year mean of 81 and 8 percent of the record count of 737 in 1962. The 5,016 steelhead trout count in 1964 was well above the 31-year mean of 3,457 and 2,062 less than in 1963. Fish other than salmon and steelhead trout passing through the fishways at Rock Island Dam in 1964 numbered 118,284 and exceeded the count of salmon and steelhead trout by 3,845 fish.

Of the 114,439 salmon and steelhead trout observed at Rock Island Dam in 1964, about 2 percent had visible evidence of injury about the head or body.

INTRODUCTION

Rock Island Dam, located on the Columbia River about 12 miles downstream from Wenatchee, Wash., has been in operation since 1933. The plant is owned and operated by Chelan County Public Utility District No. 1.

This report on passage of fish at Rock Island Dam during 1964 provides information on operations of fishways and numbers of fish using them.

Rock Island Dam has three fishways: one located on the right bank, another on the left bank, and the third about the center of the dam. The bank fish ladders began operating in 1933, and the middle ladder in 1936. All three ladders have been modified since then.

Fish ascending Rock Island Dam ladders have been counted annually since 1933, the longest continuous record of Columbia River fish counts.

Included in this report are comments covering various fishery investigations at Rock Island Dam during 1964.

COUNTING PROCEDURES

Fish counting in 1964 began on May 1 and ended October 24. From May 1 through August 31, fish were counted 16 hours each day, starting at 5 a.m. and ending at 9 p.m. From September 1 through October 10, counting was reduced to 14 hours each day, starting at 6 a.m. and ending at 8 p.m. to conform with the available daylight. From October 11 to October 24, fish counting was reduced to one shift each day from 8 a.m. to 4:30 p.m.

Fish counters were allowed a 15-minute rest period at the end of each hour. During all periods of noncounting, ladders were closed to fish.

A water glass was floated on the surface over each counting board to eliminate sunglare and water surface disturbances and thus permit clear observation of each fish.

ENUMERATION OF FISH

All species of fish using the fishways at Rock Island Dam are identified and recorded. Because of their greater importance, special mention is made of the different species of salmon and of the steelhead trout passing the dam, and each is discussed separately.

Chinook Salmon, Oncorhynchus tshawytscha

The 1964 chinook salmon count of 39,951 (jacks included) was more than twice the mean of 17,355 for the 31-year period 1933-63. It was also greater than the 1963 count and about 79 percent of the record count of 50,713 in 1957 (table 1). Monthly totals of chinook salmon given in table 2 show a peak movement of these

Note.--Paul D. Zimmer, Fishery Biologist (Management), and John H. Broughton, Fishery Technician, Bureau of Commercial Fisheries Program Office, Portland, Oreg.

Table 1.--Annual counts and periods of counting of salmon and steelhead trout at Rock Island Dam, 1933-64[1/]

(Number of fish)

Year	Chinook salmon	Sockeye salmon	Coho salmon	Steelhead trout	Total	Period of count
1933	5,668	40,737	182	1,055	47,642	7/21- 9/23
1934	7,115	2,227	69	583	9,994	7/31-12/31
1935	16,305	14,013	11	5,418	35,747	1/1 -11/15
1936	7,290	16,500	0	2,373	26,163	5/5 - 9/29
1937	5,133	15,089	58	2,214	22,494	5/11-10/16
1938	5,795	17,095	78	2,399	25,367	4/12-10/29
1939	11,206	19,591	13	5,425	36,235	5/1 -12/9
1940	9,512	27,093	2	5,220	41,827	3/5 -12/10
1941	2,507	963	28	3,513	7,011	4/1 -12/8
1942	6,833	16,340	1	3,693	26,867	4/10-11/30
1943	11,129	17,522	15	2,315	30,981	4/5 -11/30
1944	3,364	5,035	186	1,338	9,923	4/12-11/17
1945	5,699	7,148	166	1,118	14,131	4/4 -12/17
1946	9,981	45,030	32	1,779	56,822	1/4 -11/5
1947	11,717	79,831	229	1,971	93,748	1/1 -11/27
1948	7,083	84,184	29	2,360	93,656	1/1 -11/16
1949	12,353	18,600	40	2,470	33,463	1/1 -11/15
1950	10,348	50,134	72	1,852	62,406	1/1 -11/23
1951	18,752	101,826	8	3,121	123,707	1/1 -11/18
1952	20,121	114,349	27	2,883	137,380	1/1 -11/18
1953	31,080	151,747	40	4,001	186,868	1/1 -12/31
1954	33,283	91,234	44	5,406	129,967	1/1 -12/31
1955	25,658	155,055	39	3,141	183,893	5/1 - 9/30
1956	25,085	92,443	29	1,540	119,097	5/1 - 9/29
1957	50,713	71,261	27	3,927	125,928	5/1 - 9/28
1958	32,457	98,695	60	3,970	135,182	5/1 - 9/30
1959	23,352	72,351	118	4,138	99,959	5/4 - 9/30
1960	26,550	60,341	94	6,226	93,211	5/2 -10/29
1961	33,067	19,233	50	7,042	59,392	5/1 -10/27
1962	34,154	29,253	737	7,591	71,735	5/1 -10/27
1963	34,688	64,768	20	7,078	106,554	5/1 -10/30
1964	39,951	69,411	61	5,016	114,439	5/1 -10/24

1/ The above counts are now considered to be the official record of fish passing Rock Island Dam.

Table 2.--Monthly number of salmon and steelhead counted at Rock Island Dam, 1964

Species	May	June	July	August	Sept.	Oct.	Total
Chinook. . . .	6,687	2,108	7,314	6,885	2,051	413	25,458
Chinook (jacks)	461	477	1,861	5,130	5,576	988	14,493
Sockeye. . . .	5	73	54,848	13,452	919	114	69,411
Coho	0	0	0	0	26	35	61
Steelhead. . .	599	44	132	1,523	1,688	1,030	5,016
Total.	7,752	2,702	64,155	26,990	10,260	2,580	114,439

fish in August. Maximum day's count of chinook salmon (jacks excluded) was 896 on May 5 (table 3), as compared to 430 on August 5, 1963. Tables 4 and 5 show semimonthly totals of the number and percentage of chinook salmon counted over each ladder. Of the chinook salmon (jacks excluded), 51 percent ascended the left ladder, while 28 and 21 percent ascended the middle and right ladders, respectively. In 1963, percentages of chinook salmon (jacks excluded) which used the left, middle, and right ladders were 73, 14, and 13, respectively.

Table 3.--Maximum daily counts, salmon and steelhead, Rock Island Dam, 1964

Species	Date	Number of fish
Chinook (except jacks)	May 5	896
Chinook (jacks). . . .	Sept. 12	257
Sockeye.	July 27	6,247
Coho	Oct. 9, 22	5
Steelhead.	Sept. 17	129

Chinook Salmon Jacks

Some chinook salmon return from the ocean as mature fish in the year following their seaward migration and are referred to as "jacks." These fish are small and males predominate. At Rock Island Dam in 1964, all chinook salmon 24 inches or less were counted as jacks. Each counting board has a marked section, 24 inches long, for use of the counter in gaging the length of these small chinook salmon. The maximum daily count of 257 jacks occurred on September 12 (table 3), three days earlier than in 1963. The 14,493 fish recorded as jacks constituted about 36 percent of the total chinook run as compared to 56 percent in 1963.

Table 5 shows the number and percentage of chinook salmon jacks counted over each fish ladder. In 1964, 74, 14, and 12 percent of the jacks used the left, middle, and right ladders, respectively, as compared to 72, 11, and 17 percent in 1963. Monthly totals are given in table 2.

Sockeye Salmon, Oncorhynchus nerka (Blueback or Red)

The sockeye salmon count of 69,411 was about 35 percent greater than the 31-year mean of

Table 4.--Semimonthly number and percent of chinook salmon counted over each fish ladder, Rock Island Dam, 1964

(Jacks not included)

Dates	Left ladder		Middle ladder		Right ladder		Total
	Number	Percent	Number	Percent	Number	Percent	Number
May 1-15	555	13.3	1,542	37.0	2,068	49.7	4,165
16-31	975	38.7	952	37.7	595	23.6	2,522
June 1-15	348	28.4	764	62.4	112	9.2	1,224
16-30	257	29.1	532	60.2	95	10.7	884
July 1-15	1,252	48.8	874	34.1	440	17.1	2,566
16-31	2,787	58.7	1,416	29.8	545	11.5	4,748
Aug. 1-15	4,276	77.6	502	9.1	734	13.3	5,512
16-31	831	60.5	330	24.0	212	15.5	1,373
Sept. 1-15	525	85.4	50	8.1	40	6.5	615
16-30	976	68.0	228	15.9	232	16.1	1,436
Oct. 1-15	213	62.1	1/ 2	.6	128	37.3	343
16-24	44	62.9	0	0	26	37.1	70
Totals	13,039	51.2	7,192	28.3	5,227	20.5	25,458

1/ Middle ladder closed from Oct. 14-24 in order to make repairs.

Table 5.--Semimonthly number and percent of chinook salmon jacks counted over each fish ladder, Rock Island Dam, 1964

Dates	Left ladder		Middle ladder		Right ladder		Total
	Number	Percent	Number	Percent	Number	Percent	Number
May 1-15	20	9.5	80	37.9	111	52.6	211
16-31	133	53.2	83	33.2	34	13.6	250
June 1-15	153	57.3	66	24.7	48	18.0	267
16-30	107	51.0	79	37.6	24	11.4	210
July 1-15	152	46.9	90	27.8	82	25.3	324
16-31	1,069	69.6	246	16.0	222	14.4	1,537
Aug. 1-15	2,014	81.1	193	7.8	277	11.1	2,484
16-31	1,932	73.0	436	16.5	278	10.5	2,646
Sept. 1-15	2,408	83.0	335	11.5	158	5.5	2,901
16-30	1,954	73.1	418	15.6	303	11.3	2,675
Oct. 1-15	615	80.9	1/ 28	3.7	117	15.4	760
16-24	198	86.8	0	0	30	13.2	228
Totals	10,755	74.2	2,054	14.2	1,684	11.6	14,493

1/ Middle ladder closed from Oct. 14-24 in order to make repairs.

51,603 (table 1) and surpassed the 1963 run by about 4,600 fish. Peak of the run was reached on July 27, when 6,247 fish were counted through the fishways. Peak daily count in 1963 occurred on July 15 when 4,601 fish were recorded.

Table 6 shows semimonthly totals of the number and percentage of sockeye counted over each fish ladder. Of the sockeye salmon passing Rock Island Dam in 1964, 66 percent ascended the left ladder, while 15 and 19 percent ascended the middle and right ladders, respectively. Percentage distribution of sockeye through the left, middle, and right fishways in 1963 was 66, 20, and 14, respectively.

Data pertaining to sockeye salmon daily counts are in tables 9-14. Monthly totals of sockeye counted in 1964, table 2, show 79 percent of the total run passed through the fishways in July, as compared to about 90 percent during the same month in 1963.

Coho Salmon, Oncorhynchus kisutch (Silver)

The 1964 coho salmon count of 61 was about 75 percent of the 31-year mean of 81, and slightly more than 8 percent of the peak year of 737 in 1962 (table 1). The first coho was observed on September 11, 1964, as compared to September 2, 1963. Maximum day's count of 5 occurred on October 9 and 22. Of the coho salmon passing the dam in 1964, 80 percent used the left ladder, while 2 and 18 percent used the middle and right ladders, respectively (table 7). In 1963, percentages of coho were left, 40 percent; middle, 40 percent; and right, 20 percent. Additional data are shown in tables 2, 13, and 14.

Steelhead Trout, Salmo gairdneri

The 1964 steelhead trout count of 5,016 was 45 percent greater than the 31-year mean of 3,457 (table 1). In 1964, the greatest number of steelhead passed through the fishways in September when 1,688 were recorded (table 2). Peak monthly movement of these fish in 1963 also occurred in September when 2,634 were counted.

Of the steelhead passing Rock Island Dam in 1964, 76 percent used the left ladder, while 10 and 14 percent ascended the middle and right ladders, respectively (table 8). In 1963, percent utilization by ladder was: left, 76; middle, 8; and right, 16.

Table 6.--Semimonthly number and percent of sockeye salmon counted over each ladder, Rock Island Dam, 1964

Dates	Left ladder		Middle ladder		Right ladder		Total
	Number	Percent	Number	Percent	Number	Percent	Number
May 1-15	0	0	0	0	0	0	0
16-31	2	40.0	3	60.0	0	0	5
June 1-15	9	50.0	6	33.3	3	16.7	18
16-30	26	47.3	18	32.7	11	20.0	55
July 1-15	1,399	57.9	435	18.0	583	24.1	2,417
16-31	33,520	63.9	8,268	15.8	10,643	20.3	52,431
Aug. 1-15	8,279	76.9	832	7.7	1,660	15.4	10,771
16-31	1,979	73.8	383	14.3	319	11.9	2,681
Sept. 1-15	413	71.6	71	12.3	93	16.1	577
16-30	224	65.5	36	10.5	82	24.0	342
Oct. 1-15	72	66.7	1/ 6	5.5	30	27.8	108
16-24	6	100.0	0	0	0	0	6
Totals	45,929	66.2	10,058	14.5	13,424	19.3	69,411

1/ Middle ladder closed from Oct. 14-24 in order to make repairs.

Table 7.--Semimonthly number and percent of coho salmon counted over each ladder, Rock Island Dam, 1964

Dates	Left ladder		Middle ladder		Right ladder		Total
	Number	Percent	Number	Percent	Number	Percent	Number
May 1-15	0	0	0	0	0	0	0
16-31	0	0	0	0	0	0	0
June 1-15	0	0	0	0	0	0	0
16-30	0	0	0	0	0	0	0
July 1-15	0	0	0	0	0	0	0
16-31	0	0	0	0	0	0	0
Aug. 1-15	0	0	0	0	0	0	0
16-31	0	0	0	0	0	0	0
Sept. 1-15	4	80.0	0	0	1	20.0	5
16-30	17	81.0	0	0	4	19.0	21
Oct. 1-15	16	72.8	1/ 1	4.5	5	22.7	22
16-24	12	92.3	0	0	1	7.7	13
Totals	49	80.3	1	1.7	11	18.0	61

1/ Middle ladder closed from Oct. 14-24 in order to make repairs.

Table 8.--Semimonthly number and percent of steelhead trout counted over each ladder, Rock Island Dam, 1964

Dates	Left ladder		Middle ladder		Right ladder		Total
	Number	Percent	Number	Percent	Number	Percent	Number
May 1-15	117	32.5	79	21.9	164	45.6	360
16-31	108	45.2	68	28.5	63	26.3	239
June 1-15	26	68.4	7	18.4	5	13.2	38
16-30	3	50.0	2	33.3	1	16.7	6
July 1-15	6	42.9	3	21.4	5	35.7	14
16-31	78	66.1	10	8.5	30	25.4	118
Aug. 1-15	487	80.6	41	6.8	76	12.6	604
16-31	730	79.4	90	9.8	99	10.8	919
Sept. 1-15	627	87.2	47	6.5	45	6.3	719
16-30	767	79.2	108	11.1	94	9.7	969
Oct. 1-15	633	80.7	1/ 26	3.3	125	16.0	784
16-24	230	93.5	0	0	16	6.5	246
Totals	3,812	76.0	481	9.6	723	14.4	5,016

1/ Middle ladder closed from Oct. 14-24 in order to make repairs.

Maximum day's count in 1964 was 129 on September 17 (table 3), as compared to 201 on September 15, 1963. Additional data pertaining to the movement of steelhead trout at Rock Island Dam are contained in tables 9-14.

Miscellaneous Fish

In 1964, species of fish passing Rock Island Dam other than salmon and steelhead trout were counted as in former years (tables 15-20). No claims are made as to complete accuracy of identification of these fish; however, the degree of accuracy is consistent with that maintained at other dams on the Columbia River. Such data should only be used as a rough index of abundance of these fish.

In 1964, 118,284 fish other than salmon and steelhead trout passed Rock Island Dam. This number, as compared to 138,000 in 1963, exceeded the count of salmon and steelhead trout by about 4,000. The species included are largescale sucker, Catostomus macrocheilus; longnose sucker, Catostomus catostomus; squawfish, Ptychocheilus oregonense; Rocky Mountain whitefish, Prosopium williamsoni; Columbia River chub, Mylocheilus caurinus; carp, Cyprinus carpio; lamprey, Entosphenus tridentatus; Dolly Varden trout, Salvelinus malma; and rainbow trout, Salmo gairdneri.

Table 9.--Daily air and water temperatures, stream flows, and fish counts, Rock Island Dam, May 1964

Date	Air temperatures[1]		Water temperatures[2]		Stream flow	Chinook	Sockeye	Coho	Steelhead	Total
	Max.	Min.	Max.	Min.						
	°F.	°F.	°F.	°F.	c.f.s.	Number	Number	Number	Number	Number
May 1	64	46	45	44	46,400	50	0	0	23	73
2	62	46	45	44	42,700	35	0	0	12	47
3	70	42	46	45	38,100	72	0	0	10	82
4	68	54	46	45	39,500	352	0	0	65	417
5	71	45	46	45	40,100	912	0	0	53	965
6	71	46	46	45	51,800	82	0	0	7	89
7	78	46	46	45	40,000	245	0	0	25	270
8	74	54	47	45	89,100	558	0	0	24	582
9	74	54	46	45	99,700	424	0	0	32	456
10	68	54	46	45	109,400	300	0	0	27	327
11	70	55	46	46	112,400	319	0	0	16	335
12	67	57	46	46	129,300	307	0	0	26	333
13	64	42	47	46	129,800	300	0	0	14	314
14	72	42	46	45	150,500	266	0	0	15	281
15	76	42	47	45	154,500	154	0	0	11	165
16	80	54	48	46	156,200	224	0	0	12	236
17	80	57	48	47	156,200	422	0	0	31	453
18	82	56	48	47	162,500	163	0	0	8	171
19	86	62	49	49	186,200	300	0	0	17	317
20	70	58	49	49	208,300	209	0	0	30	239
21	60	51	50	48	232,200	253	1	0	21	275
22	64	42	50	48	240,100	238	1	0	11	250
23	79	42	49	48	241,100	127	1	0	11	139
24	64	47	49	48	232,100	171	0	0	11	182
25	78	43	50	49	230,600	64	0	0	6	70
26	74	49	51	50	246,100	54	0	0	12	66
27	87	50	51	50	249,000	91	0	0	12	103
28	84	62	52	50	254,100	186	2	0	18	206
29	78	56	53	51	260,800	125	0	0	12	137
30	84	60	52	51	274,700	41	0	0	10	51
31	90	58	53	52	279,400	104	0	0	17	121

1/ Air temperatures were taken with maximum and minimum thermometer.

2/ Water temperatures were taken with a thermograph located in the middle ladder.

Table 10.-- Daily air and water temperatures, stream flows, and fish counts, Rock Island Dam, June 1964

Date	Air temperatures[1] Max.	Air temperatures[1] Min.	Water temperatures[2] Max.	Water temperatures[2] Min.	Stream flow	Chinook	Sockeye	Coho	Steelhead	Total
	°F.	°F.	°F.	°F.	c.f.s.	Number	Number	Number	Number	Number
June 1	82	64	53	52	297,000	153	1	0	7	161
2	78	58	53	52	301,700	167	0	0	2	169
3	84	50	53	52	326,700	84	0	0	6	90
4	74	60	52	52	324,900	16	0	0	1	17
5	80	56	52	52	323,800	83	0	0	3	86
6	81	55	53	52	321,000	165	0	0	2	167
7	80	54	53	52	313,700	46	0	0	1	47
8	66	50	52	52	313,100	54	0	0	1	55
9	82	56	52	52	313,200	53	0	0	1	54
10	82	60	53	52	335,900	25	0	0	0	25
11	80	62	54	52	374,100	39	3	0	3	45
12	80	56	53	52	396,200	56	1	0	0	57
13	92	59	54	53	403,900	247	3	0	4	254
14	88	62	54	53	418,700	176	4	0	6	186
15	86	60	55	54	424,700	127	6	0	1	134
16	68	56	55	54	433,800	117	5	0	1	123
17	80	57	54	54	451,900	97	7	0	1	105
18	76	60	54	54	447,600	86	5	0	0	91
19	80	60	54	53	435,700	69	0	0	0	69
20	78	54	54	53	422,100	73	2	0	0	75
21	82	56	55	53	418,900	106	0	0	0	106
22	86	60	55	54	413,400	88	1	0	0	89
23	90	61	56	55	415,800	51	12	0	1	64
24	89	58	56	55	422,100	65	4	0	0	69
25	88	59	55	55	430,300	57	3	0	1	61
26	89	64	56	55	421,500	67	2	0	0	69
27	74	53	55	54	414,600	40	4	0	0	44
28	80	48	55	54	395,200	83	2	0	1	86
29	84	53	55	54	387,800	54	5	0	0	59
30	89	62	56	55	380,900	41	3	0	1	45

1/ Air temperatures were taken with maximum and minimum thermometer.

2/ Water temperatures were taken with a thermograph located in the middle ladder.

Table 11.--Daily air and water temperatures, stream flows, and fish counts, Rock Island Dam, July 1964

Date		Air temperatures[1]		Water temperatures[2]		Stream flow	Chinook	Sockeye	Coho	Steel-head	Total
		Max.	Min.	Max.	Min.						
		°F.	°F.	°F.	°F.	c.f.s.	Number	Number	Number	Number	Number
July	1	96	62	56	55	369,300	62	24	0	2	88
	2	80	65	56	55	360,800	91	7	0	1	99
	3	86	58	56	54	345,200	111	2	0	0	113
	4	84	57	56	54	333,500	129	16	0	2	147
	5	94	65	56	55	318,000	128	24	0	1	153
	6	90	60	57	55	309,900	150	21	0	0	171
	7	96	63	57	55	326,500	106	19	0	0	125
	8	92	65	58	56	340,700	171	38	0	0	209
	9	84	56	58	56	348,200	229	53	0	1	283
	10	88	57	58	57	327,900	213	82	0	0	295
	11	104	76	58	56	330,100	292	116	0	2	410
	12	106	68	59	57	328,500	260	204	0	2	466
	13	98	72	59	57	333,200	307	418	0	2	727
	14	82	62	59	58	333,100	382	697	0	1	1,080
	15	80	61	58	57	325,700	259	696	0	0	955
	16	82	59	59	57	330,900	245	1,543	0	1	1,789
	17	88	64	59	57	310,200	336	2,013	0	2	2,351
	18	78	64	59	57	302,300	286	1,945	0	1	2,232
	19	88	69	59	57	300,500	292	3,211	0	0	3,503
	20	90	61	60	58	301,500	308	3,834	0	1	4,143
	21	80	61	-	-	292,000	343	3,520	0	0	3,863
	22	74	62	61	60	272,000	406	4,386	0	8	4,800
	23	84	60	61	60	251,700	293	3,719	0	2	4,014
	24	94	58	61	60	241,300	300	2,889	0	4	3,193
	25	100	64	61	60	240,200	334	3,852	0	6	4,192
	26	100	68	61	60	228,600	513	4,683	0	5	5,201
	27	100	67	62	61	222,000	609	6,247	0	10	6,866
	28	104	68	62	61	209,900	544	4,256	0	13	4,813
	29	88	62	61	61	178,600	665	3,005	0	18	3,688
	30	82	63	61	61	182,800	502	1,705	0	24	2,231
	31	78	65	61	61	185,700	309	1,623	0	23	1,955

1/ Air temperatures were taken with maximum and minimum thermometer.

2/ Water temperatures were taken with a thermograph located in the middle ladder.

Table 12.--Daily air and water temperatures, stream flows, and fish counts, Rock Island Dam, August 1964

Date	Air temperatures[1] Max.	Air temperatures[1] Min.	Water temperatures[2] Max.	Water temperatures[2] Min.	Stream flow	Chinook	Sockeye	Coho	Steelhead	Total
	°F.	°F.	°F.	°F.	c.f.s.	Number	Number	Number	Number	Number
Aug. 1	70	57	61	60	207,400	439	1,807	0	24	2,270
2	84	54	60	60	210,400	759	836	0	26	1,621
3	71	57	61	60	184,400	644	1,009	0	22	1,675
4	84	63	62	61	176,000	494	935	0	27	1,456
5	82	53	61	60	156,800	306	607	0	30	943
6	86	54	62	60	132,400	392	1,054	0	25	1,471
7	92	62	62	60	112,500	669	479	0	24	1,172
8	82	63	62	61	116,900	741	737	0	45	1,523
9	84	67	62	61	125,300	677	644	0	46	1,367
10	84	56	62	61	144,300	697	515	0	59	1,271
11	98	56	63	62	123,900	613	535	0	40	1,188
12	86	66	62	61	122,000	492	715	0	81	1,288
13	86	63	62	61	133,300	429	300	0	59	788
14	82	56	62	61	144,500	363	276	0	46	685
15	82	61	62	61	149,100	281	322	0	50	653
16	92	65	63	61	149,600	327	244	0	65	636
17	90	65	63	62	146,400	285	371	0	59	715
18	75	65	64	62	121,400	272	232	0	50	554
19	79	59	63	62	114,200	338	295	0	67	700
20	88	58	63	62	117,000	266	196	0	72	534
21	90	58	63	62	117,500	254	204	0	31	489
22	94	65	64	63	123,400	210	202	0	74	486
23	92	68	64	63	120,600	190	174	0	56	420
24	86	67	63	63	121,300	250	100	0	54	404
25	76	60	63	62	109,000	225	125	0	51	401
26	78	59	63	62	111,700	199	118	0	68	385
27	70	59	62	62	102,000	358	115	0	74	547
28	74	58	62	61	72,600	209	89	0	49	347
29	76	59	62	61	50,500	200	56	0	43	299
30	70	52	62	61	94,400	282	91	0	60	433
31	72	53	62	61	75,800	154	69	0	46	269

1/ Air temperatures were taken with maximum and minimum thermometer.

2/ Water temperatures were taken with a thermograph located in the middle ladder.

Table 13.--Daily air and water temperatures, stream flows, and fish counts, Rock Island Dam, September 1964

Date	Air temperatures[1] Max.	Air temperatures[1] Min.	Water temperatures[2] Max.	Water temperatures[2] Min.	Stream flow	Chinook	Sockeye	Coho	Steelhead	Total
	°F.	°F.	°F.	°F.	c.f.s.	Number	Number	Number	Number	Number
Sept. 1	78	49	62	61	67,800	254	59	0	53	366
2	74	56	62	61	69,500	173	46	0	33	252
3	78	53	62	61	71,100	164	33	0	13	210
4	82	53	62	61	48,700	154	39	0	52	245
5	80	56	62	61	54,100	171	34	0	46	251
6	82	58	62	61	49,200	259	90	0	66	415
7	74	60	62	62	69,500	267	71	0	39	377
8	72	52	62	62	60,800	273	40	0	57	370
9	74	49	62	61	74,900	213	32	0	31	276
10	74	53	62	61	49,100	178	39	0	47	264
11	75	46	62	61	56,500	297	19	3	58	377
12	70	48	62	61	61,100	319	16	1	73	409
13	82	50	62	60	48,900	232	21	0	37	290
14	76	65	62	61	42,300	292	16	1	57	366
15	84	60	62	61	49,300	270	22	0	57	349
16	82	60	62	61	52,800	345	32	0	87	464
17	70	58	62	61	59,500	421	23	0	129	573
18	70	54	62	61	45,300	262	24	4	55	345
19	70	51	61	61	56,900	382	43	3	116	544
20	72	53	62	61	39,200	338	43	3	80	464
21	64	52	61	61	40,200	359	39	4	66	468
22	80	51	62	61	67,600	309	22	0	63	394
23	80	61	61	61	56,100	327	21	1	56	405
24	84	62	62	61	77,900	269	13	3	45	330
25	75	61	62	61	78,300	197	20	1	55	273
26	76	57	62	61	75,700	195	15	1	51	262
27	78	46	61	61	74,700	213	20	0	41	274
28	74	50	61	61	78,200	176	21	0	34	231
29	65	59	61	61	60,500	171	3	1	43	218
30	66	58	62	61	75,400	147	3	0	48	198

1/ Air temperatures were taken with maximum and minimum thermometer.

2/ Water temperatures were taken with a thermograph located in the middle ladder.

Table 14.--Daily air and water temperatures, stream flows, and fish counts, Rock Island Dam, October 1964

Date	Air temperatures[1] Max.	Air temperatures[1] Min.	Water temperatures[2] Max.	Water temperatures[2] Min.	Stream flow	Chinook	Sockeye	Coho	Steelhead	Total
	°F.	°F.	°F.	°F.	c.f.s.	Number	Number	Number	Number	Number
Oct. 1	67	47	61	61	88,500	87	11	0	31	129
2	70	52	61	60	86,000	109	17	0	74	200
3	70	46	60	60	100,200	120	8	0	59	187
4	72	46	60	59	102,400	92	7	3	59	161
5	72	42	60	59	95,900	75	22	2	55	154
6	75	42	60	60	89,300	83	9	3	82	177
7	78	42	60	60	86,100	102	10	2	84	198
8	74	60	61	60	93,600	63	3	2	60	128
9	60	50	60	60	90,600	51	7	5	48	111
10	62	46	60	60	83,100	77	1	2	56	136
11	71	50	61	60	78,100	52	6	3	39	100
12	72	49	61	60	86,500	41	3	0	44	88
13	73	50	61	60	98,700	45	1	0	49	95
14	72	52	59	59	91,800	65	3	0	26	94
15	62	46	59	59	94,000	41	0	0	18	59
16	60	40	58	56	95,300	45	1	1	44	91
17	60	38	57	56	98,700	47	3	0	46	96
18	58	38	58	57	97,400	19	0	1	17	37
19	62	38	58	57	93,700	32	1	0	23	56
20	68	38	58	57	87,700	32	0	0	22	54
21	66	40	58	57	89,500	40	0	2	22	64
22	68	42	58	57	75,400	34	0	5	31	70
23	66	42	58	57	74,600	20	1	2	15	38
24	65	43	58	57	62,100	29	0	2	26	57

1/ Air temperatures were taken with maximum and minimum thermometer.

2/ Water temperatures were taken with a thermograph located in the middle ladder.

Table 15.--Miscellaneous fish counted, Rock Island Dam, May 1964

(Number of fish)

Date	Sucker	Squawfish	Whitefish	Chub	Carp	Lamprey	Dolly Varden	Rainbow Trout	Total
May 1	10	0	27	0	0	0	0	0	37
2	9	0	58	2	0	0	0	0	69
3	7	0	48	0	0	0	0	0	55
4	13	1	56	0	0	0	0	0	70
5	12	0	40	0	0	0	0	1	53
6	7	1	73	0	0	0	0	0	81
7	7	0	112	1	0	0	0	0	120
8	12	2	128	1	0	0	0	0	143
9	200	1	87	11	0	0	0	0	299
10	352	1	98	16	0	0	0	2	469
11	295	3	48	4	0	0	0	0	350
12	116	3	33	2	0	0	0	0	154
13	30	0	41	0	0	0	0	0	71
14	21	0	23	0	0	0	0	0	44
15	6	3	14	2	0	0	0	0	25
16	27	5	23	1	0	0	0	0	56
17	243	30	45	15	0	0	0	1	334
18	431	25	36	7	0	0	0	1	500
19	1,256	56	145	20	0	0	0	0	1,477
20	820	55	101	17	0	0	0	0	993
21	335	31	31	1	0	0	0	2	400
22	72	4	8	0	0	0	0	0	84
23	30	7	11	0	0	0	0	2	50
24	13	4	8	2	0	0	0	0	27
25	23	17	9	0	0	0	0	1	50
26	374	68	84	20	0	0	0	0	546
27	350	55	65	15	0	0	0	0	485
28	843	219	91	73	0	0	0	1	1,227
29	1,705	171	83	299	0	0	1	1	2,260
30	681	68	57	85	0	0	0	0	891
31	431	32	20	101	0	0	0	1	585
Total	8,731	862	1,703	695	0	0	1	13	12,005

Table 16.--Miscellaneous fish counted, Rock Island Dam, June 1964

(Number of fish)

Date	Sucker	Squawfish	Whitefish	Chub	Carp	Lamprey	Dolly Varden	Rainbow Trout	Total
June 1	191	33	16	46	0	0	0	0	286
2	72	9	6	16	0	0	0	0	103
3	67	3	8	0	0	0	0	0	78
4	45	4	0	9	0	0	0	0	58
5	47	25	3	4	1	0	0	0	80
6	152	21	19	2	0	0	0	0	194
7	283	37	0	20	0	0	0	0	340
8	207	16	1	20	0	0	0	0	244
9	130	5	10	27	0	0	0	0	172
10	215	20	8	15	0	0	0	0	258
11	676	64	6	30	2	0	0	1	779
12	863	34	6	21	0	0	0	0	924
13	663	22	16	24	0	0	0	0	725
14	1,258	58	6	35	0	0	0	0	1,357
15	987	57	0	58	1	0	0	0	1,103
16	1,104	67	32	24	0	3	0	0	1,230
17	397	22	9	13	1	1	0	0	443
18	50	10	0	9	0	5	0	0	74
19	49	13	0	10	0	0	0	0	72
20	73	15	6	28	0	0	0	0	122
21	513	15	10	72	2	4	0	1	617
22	954	40	22	92	0	7	0	0	1,115
23	2,224	400	2	65	2	2	0	0	2,695
24	866	104	6	35	0	5	0	0	1,016
25	374	21	3	12	3	0	0	1	414
26	400	60	8	15	0	0	0	1	484
27	138	21	6	2	0	0	0	0	167
28	97	18	1	42	1	1	0	0	160
29	224	52	0	88	0	1	0	1	366
30	281	113	7	16	0	1	0	2	420
Totals	13,600	1,379	217	850	13	30	0	7	16,096

Table 17.--Miscellaneous fish counted, Rock Island Dam, July 1964

(Number of fish)

Date	Sucker	Squawfish	Whitefish	Chub	Carp	Lamprey	Dolly Varden	Rainbow trout	Total
July 1	1,869	303	4	165	0	12	0	0	2,353
2	1,466	147	13	101	1	0	0	0	1,728
3	311	64	3	25	0	2	0	0	405
4	413	70	8	10	0	2	0	0	503
5	1,393	302	7	119	0	2	0	0	1,823
6	1,584	385	9	166	3	15	1	5	2,168
7	1,535	279	21	104	3	10	0	0	1,952
8	2,085	168	28	73	2	19	0	0	2,375
9	601	52	1	35	4	6	0	1	700
10	325	73	4	16	2	2	0	0	422
11	635	142	4	35	0	3	0	0	819
12	1,948	274	7	153	3	14	0	3	2,402
13	2,475	367	16	86	4	7	1	1	2,957
14	1,717	167	12	76	2	0	1	0	1,975
15	469	67	7	13	2	0	0	0	558
16	648	75	9	8	4	3	0	1	748
17	613	73	3	23	2	0	1	0	715
18	427	56	3	17	1	2	1	1	508
19	720	69	1	68	6	0	0	1	865
20	1,880	341	6	99	9	5	1	2	2,343
21	1,016	190	5	34	0	3	0	0	1,248
22	332	47	9	33	3	2	0	0	426
23	193	45	4	18	1	2	0	1	264
24	700	190	13	23	3	1	0	0	930
25	751	238	11	57	1	2	0	0	1,060
26	1,115	286	8	73	4	2	0	0	1,488
27	1,181	444	13	171	11	4	0	2	1,826
28	771	302	7	120	12	0	0	1	1,213
29	1,072	248	23	138	29	4	0	0	1,514
30	683	222	11	55	25	5	1	0	1,002
31	972	51	19	135	17	3	0	0	1,197
Total	31,900	5,737	289	2,249	154	132	7	19	40,487

Table 18.--Miscellaneous fish counted, Rock Island Dam, August 1964

(Number of fish)

Date	Sucker	Squawfish	Whitefish	Chub	Carp	Lamprey	Dolly Varden	Rainbow trout	Total
Aug. 1	531	31	9	33	28	3	0	0	635
2	93	8	20	14	10	9	0	0	154
3	72	44	11	8	12	11	0	1	159
4	375	113	2	15	8	10	0	0	523
5	358	133	3	18	5	6	0	0	523
6	449	345	3	80	6	18	0	0	901
7	739	555	25	157	11	9	1	0	1,497
8	938	678	44	164	13	15	0	0	1,852
9	817	148	10	75	13	11	0	0	1,074
10	252	68	8	28	19	9	0	1	385
11	437	598	21	37	22	16	0	0	1,131
12	734	21	24	511	16	6	1	1	1,314
13	247	43	11	22	13	8	0	0	344
14	252	42	17	8	5	10	0	0	334
15	156	30	9	18	19	13	1	0	246
16	567	243	12	29	14	17	0	0	882
17	615	244	11	92	2	15	0	1	980
18	456	182	7	86	15	4	0	0	750
19	607	36	18	41	6	8	0	1	717
20	1,837	361	17	107	11	7	0	0	2,340
21	964	170	16	69	17	21	0	0	1,257
22	1,022	209	21	44	28	15	0	2	1,341
23	1,085	335	29	153	20	18	0	1	1,641
24	644	106	35	72	7	34	0	0	898
25	348	91	37	139	7	13	0	0	635
26	452	53	41	69	9	3	1	0	628
27	609	98	64	75	14	13	0	0	873
28	322	44	35	19	4	8	0	2	434
29	583	59	28	39	4	22	0	0	735
30	918	83	38	36	5	4	1	1	1,086
31	492	48	35	26	4	31	0	0	636
Total	17,971	5,219	661	2,284	367	387	5	11	26,905

Table 19.--Miscellaneous fish counted, Rock Island Dam, September 1964

(Number of fish)

Date	Sucker	Squawfish	Whitefish	Chub	Carp	Lamprey	Dolly Varden	Rainbow trout	Total
Sept. 1	228	50	36	21	4	44	0	0	383
2	192	67	35	25	0	81	0	0	400
3	489	114	32	26	0	34	0	0	695
4	632	124	29	53	2	26	1	1	868
5	952	280	37	62	1	30	0	0	1,362
6	1,189	409	45	109	5	157	0	1	1,915
7	1,291	199	32	110	1	71	0	0	1,704
8	782	138	21	100	0	70	0	0	1,111
9	231	79	36	46	7	38	0	0	437
10	176	70	32	40	1	40	0	1	360
11	167	61	26	43	2	84	0	0	383
12	324	93	35	30	1	12	0	0	495
13	553	117	49	40	2	14	0	0	775
14	324	136	32	64	5	49	0	0	610
15	152	73	48	42	0	18	0	0	333
16	189	69	69	50	0	14	0	0	391
17	411	134	43	34	2	17	0	0	641
18	163	51	34	31	4	3	0	0	286
19	451	130	43	39	9	2	0	0	674
20	426	98	24	49	4	7	0	1	609
21	282	77	44	42	4	11	0	0	460
22	148	88	39	65	3	15	0	0	358
23	229	70	46	61	0	29	0	1	436
24	255	119	53	139	0	35	0	1	602
25	236	73	65	74	2	16	0	0	466
26	142	75	53	24	3	9	0	0	306
27	286	82	73	56	2	9	0	0	508
28	427	141	78	66	0	23	0	2	737
29	87	68	69	98	3	19	0	0	344
30	34	21	65	40	2	17	0	1	180
Total	11,448	3,306	1,323	1,679	69	994	1	9	18,829

Table 20.--Miscellaneous fish counted, Rock Island Dam, October 1964

(Number of fish)

Date	Sucker	Squawfish	Whitefish	Chub	Carp	Lamprey	Dolly Varden	Rainbow trout	Total
Oct. 1	24	18	66	11	1	3	0	0	123
2	36	22	102	13	2	12	0	0	187
3	30	20	79	3	0	3	0	1	136
4	77	26	74	4	2	2	0	0	185
5	24	16	85	6	0	4	0	0	135
6	32	33	120	8	1	3	0	1	198
7	68	54	142	13	2	2	0	1	282
8	144	32	131	8	1	9	0	2	327
9	156	40	102	12	0	4	0	0	314
10	101	13	103	5	0	2	0	1	225
11	50	9	59	1	0	5	0	0	124
12	22	6	57	0	3	3	1	0	92
13	33	8	89	5	0	3	0	0	138
14	40	12	84	6	1	3	0	0	146
15	30	2	101	1	1	3	0	1	139
16	14	4	83	4	2	4	0	2	113
17	16	6	91	5	0	0	0	0	118
18	15	6	98	0	0	0	0	0	119
19	23	5	97	0	0	0	0	0	125
20	19	5	110	2	0	0	0	0	136
21	57	5	79	0	1	0	0	0	142
22	29	2	131	1	0	1	0	2	166
23	26	3	105	3	0	1	0	0	138
24	13	4	134	0	1	1	0	1	154
Total	1,079	351	2,322	111	18	68	1	12	3,962

WEATHER AND RIVER DISCHARGE DATA

Headwater and tailwater elevations are plotted on figures 1 and 2. Air temperatures were taken twice daily by maximum and minimum thermometer. A continuous record of water temperatures was taken by thermograph at the middle fish ladder. Daily records of weather conditions and stream flows are shown in tables 9-14.

Average daily river discharge data are plotted on figure 3. Maximum daily discharge of 451,900 c.f.s. on June 17 exceeded the 1963 record high discharge of 308,400 c.f.s. which also occurred on June 17.

Maximum water temperature of 64° F. occurred August 18, 22, and 23. In 1963, maximum water temperature of 65° F. occurred August 6-10, 13, 16, and September 6-12.

ACTIVITIES AND OBSERVATIONS

The waterflow was reduced in the right fish ladder on April 28, 1964, from 9:15 to 11:15 a.m. to clear the submerged orifices and remove accumulated debris. The flow of water was again reduced in this ladder on August 31 from 1:00 to 2:10 p.m. to repair broken chains on an adjustable weir. The left ladder was closed to fish migration on October 15 to permit repairs to the auxiliary water trash rack and to the diffusion box grating. The middle ladder was inoperative from October 15-24 in order to make repairs.

As part of an evaluation study of effects of Wanapum Dam reservoir encroachment on the ladders at Rock Island Dam, a program of trapping and tagging was conducted by the Bureau of Commercial Fisheries. Chinook were taken in a floating trap at exit of the left ladder, and sockeye were taken by a trap at the counting station inside the left ladder. All fish taken were tagged with numbered Petersen disks and released about 1,000 feet below the dam in equal amounts on each bank of the river. Trapping and tagging was conducted May 19-28 for chinook and July 15 to August 5 for sockeye. A total of 103 chinook and 955 sockeye were tagged and released. Numbers of tagged fish returning through the ladders were: chinook, 92; sockeye, 898.

Two chinook salmon tagged by the Fish Commission of Oregon on the lower Columbia in early spring were observed passing over Rock Island Dam in May.

On several occasions during the counting season, spillway gate operations were changed to improve ladder approach conditions.

During early spring of 1964 and prior to the counting season, modifications were made to the middle ladder auxiliary water supply structure.

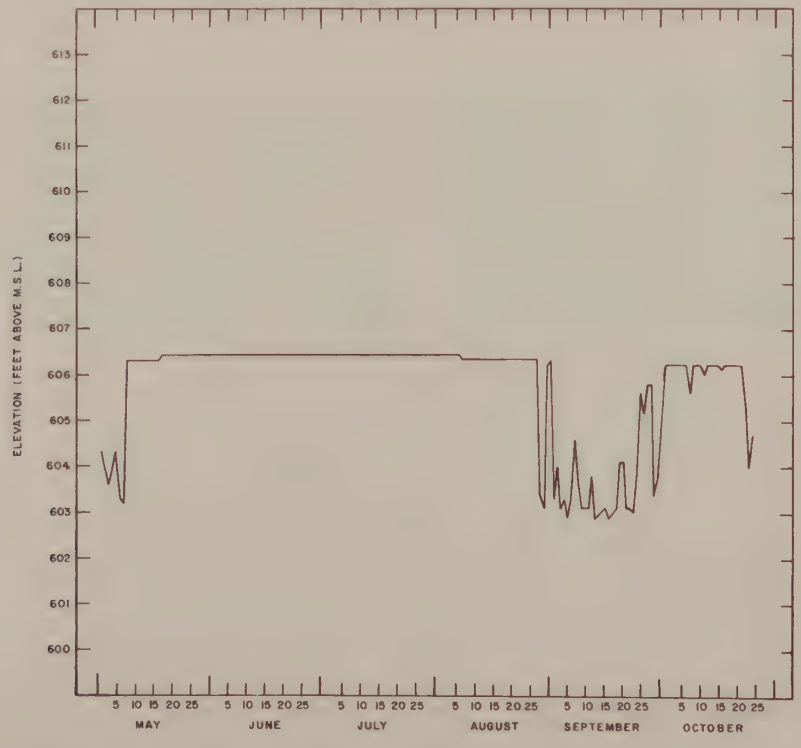

Figure 1.--Headwater elevations, Rock Island Dam, May 1 to October 24, 1964.

Figure 2.--Tailwater elevations, Rock Island Dam, May 1 to October 24, 1964.

During 1964, fish were observed with cuts or abrasions on their heads and bodies. Of the 114,439 salmon and steelhead observed as they passed over the counting boards, 2,225 fish, about 2 percent, had injuries (table 21). This same percentage of injuries was noted in 1963. Since in both years the counters could see only the top and one

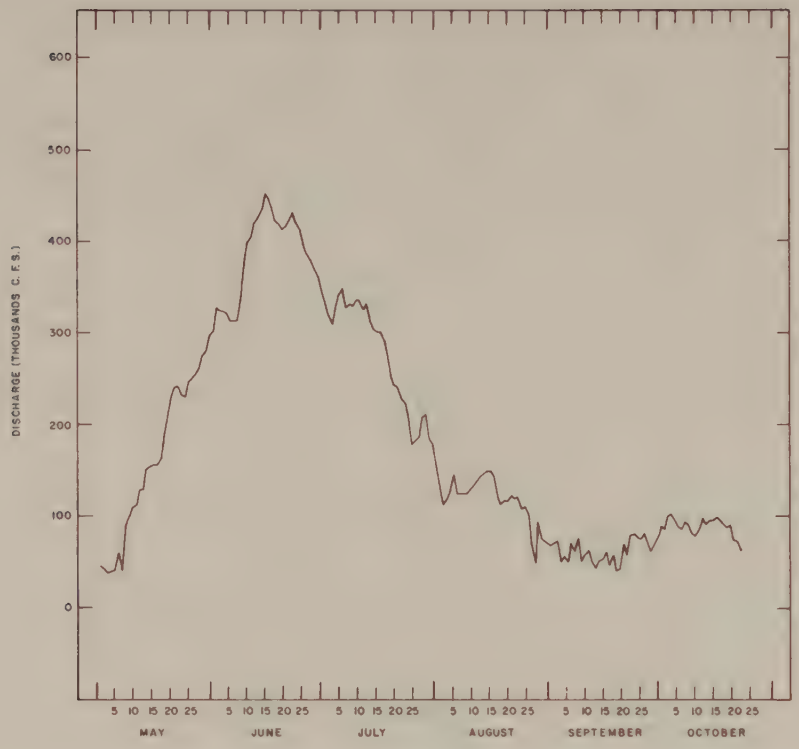

Figure 3.--Daily river discharge, Rock Island Dam, May 1 to October 24, 1964.

side of each fish, the incidence of injury might have been greater than observed. Of the total number of injured fish observed in 1964, about 56, 23, and 21 percent were recorded in the left, middle, and right ladders, respectively. In 1963, these percentages were 64, 19, and 17. As in previous years, the greatest number of injuries was observed on the large chinook and sockeye salmon. In the 2-week period July 16-31, 52,431 sockeye were counted through the fishways and injuries noted on about 2 percent of them. In 1963, during the same period, about 4 percent of the sockeye salmon observed had injuries.

Throughout the counting season, State and Federal fisheries personnel made frequent inspections of fishway operations at Rock Island Dam. Inspections were similar to those conducted at other main stem dams where fishways were being operated.

Table 21.--Injured fish observed at Rock Island Dam,
May 1 to October 24, 1964

(Number of fish)

Date	Species	Total fish counted	Injured fish observed			
			Left ladder	Middle ladder	Right ladder	Total
May 1-15	Chinook	4,165	5	9	8	22
	Chinook jacks	211	0	0	0	0
	Steelhead	360	0	0	0	0
May 16-31	Chinook	2,522	10	10	11	31
	Chinook jacks	250	0	0	0	0
	Sockeye	5	0	0	0	0
	Steelhead	239	0	0	0	0
June 1-15	Chinook	1,224	4	6	0	10
	Chinook jacks	267	0	0	0	0
	Sockeye	18	0	0	0	0
	Steelhead	38	0	0	0	0
June 16-30	Chinook	884	3	12	2	17
	Chinook jacks	210	0	0	0	0
	Sockeye	55	0	0	0	0
	Steelhead	6	0	0	0	0
July 1-15	Chinook	2,566	20	21	7	48
	Chinook jacks	324	0	0	0	0
	Sockeye	2,417	22	2	1	25
	Steelhead	14	0	0	0	0
July 16-31	Chinook	4,748	61	67	12	140
	Chinook jacks	1,537	0	0	0	0
	Sockeye	52,431	583	280	281	1,144
	Steelhead	118	0	0	0	0
Aug. 1-15	Chinook	5,512	123	28	24	175
	Chinook jacks	2,484	1	0	1	2
	Sockeye	10,771	247	44	102	393
	Steelhead	604	0	0	0	0
Aug. 16-31	Chinook	1,373	31	16	4	51
	Chinook jacks	2,646	3	0	0	3
	Sockeye	2,681	74	21	4	99
	Steelhead	919	2	0	0	2
Sept. 1-15	Chinook	615	15	0	1	16
	Chinook jacks	2,901	1	0	0	1
	Sockeye	577	12	0	0	12
	Coho	5	0	0	0	0
	Steelhead	719	2	0	0	2
Sept. 16-30	Chinook	1,436	5	2	1	8
	Chinook jacks	2,675	3	0	2	5
	Sockeye	342	6	0	2	8
	Coho	21	0	0	0	0
	Steelhead	969	1	0	0	1
Oct. 1-15	Chinook	343	4	0	0	4
	Chinook jacks	760	0	0	0	0
	Sockeye	108	2	0	0	2
	Coho	22	0	0	0	0
	Steelhead	784	1	0	0	1
Oct. 16-24	Chinook	70	1	0	1	2
	Chinook jacks	228	0	0	0	0
	Sockeye	6	0	0	0	0
	Coho	13	0	0	0	0
	Steelhead	246	1	0	0	1
Totals		114,439	1,243	518	464	2,225

SUMMARY

1. The total Rock Island Dam count of salmon and steelhead in 1964 was 114,439, about 7,900 more than in 1963.

2. The chinook salmon count of 39,951 (jacks included) was 5,263 more than in 1963, more than two-thirds the peak year of 1957, and exceeded the 31-year average by about 22,600 fish. In 1964, 14,493 jacks were recorded, representing about 36 percent of that year's total chinook salmon counted. In 1963, jacks represented about 56 percent of the chinook run.

3. The sockeye count of 69,411 in 1964 exceeded the 1963 count by 4,643 fish and was 17,808 more than the 31-year mean of 51,603.

4. The coho salmon count of 61 in 1964 was about 75 percent of the 31-year mean of 81 fish and slightly more than 8 percent of the peak year 1962 when 737 were counted.

5. The steelhead count of 5,016 in 1964 was 2,062 less than the 1963 count and 1,559 more than the 31-year mean of 3,457.

6. In 1964, as in previous years, a greater percentage of salmon and steelhead used the left bank fish ladder than either of the other ladders.

7. Counting began May 1 and terminated October 24. From May 1 through August 31, counting was conducted 16 hours each day; from September 1 through October 10, counting was reduced to 14 hours each day, 6 a.m. to 8 p.m., to conform to hours of daylight available. From October 11 to 24, counting was reduced to one shift per day, 8 a.m. to 4:30 p.m.

8. In 1964, maximum number of salmonids counted in one day (6,866) occurred on July 27.

9. Season's total fish other than salmon and steelhead trout passing Rock Island Dam in 1964 was 118,284, composed of the following: sucker, 84,729; squawfish, 16,854; whitefish, 6,515; chub, 7,868; carp, 621; lamprey, 1,611; Dolly Varden and rainbow trout, 86.

10. Of the 114,439 salmon and steelhead examined, on the top and one side only as they passed over the counting boards, as in 1963 about 2 percent had injuries of some type either on the body or about the head. Most injuries were observed in July and August. Large chinook and sockeye salmon suffered a higher rate of injury than small chinook, steelhead, and coho.

MS. #1457

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